



Interactive Generative Design

Postgraduate Dissertation

Interactive War Conflict Installation

Stelios Passos

Supervisor: Anna Laskari

Athens, Greece, January 2025

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Stelios Passos

Supervising Committee

Supervisor:

Anna Laskari

Hellenic Open University

Co-Supervisor:

Sokratis Giannoudis

Hellenic Open University

Athens, Greece, January 2025

“My friends and family”

Abstract

This dissertation examines the design and development of an interactive digital installation that explores the global impact of imperialist war conflicts, with its functionality validated through an HTML-based test environment. At its core, the installation uses a locally run artificial intelligence (AI) language model to generate and present narratives and visual data based on a curated database. Combining minimalist digital aesthetics with interactive elements such as dynamic text, graphs, and ambient soundscapes, the installation seeks to engage users in a reflective experience. Drawing inspiration from the works of Ryoji Ikeda and the visual design of United Visual Artists for Massive Attack, the project aims to balance emotional detachment with immersion, fostering critical thought about the human cost of war. The final physical implementation remains conceptual, with technical feasibility demonstrated via modular component documentation and simulated user interactions.

Keywords

Interaction design, Interactive Installation, Global Conflicts, LLM

Διαδραστική Εγκατάσταση Πολεμικών Συρράξεων

Στέλιος Πάσος

Περίληψη

Αυτή η διπλωματική εξετάζει το σχεδιασμό και την ανάπτυξη μιας διαδραστικής ψηφιακής εγκατάστασης που διερευνά τον παγκόσμιο αντίκτυπο των ιμπεριαλιστικών πολεμικών συγκρούσεων, με τη λειτουργικότητά της να επαληθεύεται μέσω ενός περιβάλλοντος δοκιμών βασισμένου σε HTML. Στον πυρήνα της, η εγκατάσταση χρησιμοποιεί ένα τοπικά εκτελούμενο γλωσσικό μοντέλο τεχνητής νοημοσύνης (AI) για τη δημιουργία και την παρουσίαση αφηγήσεων και οπτικών δεδομένων, βασισμένων σε μια επιμελημένη βάση δεδομένων. Συνδυάζοντας μια μινιμαλιστική ψηφιακή αισθητική με διαδραστικά στοιχεία, όπως δυναμικό κείμενο, γραφήματα και περιβαλλοντικές ηχοτοπίες, η εγκατάσταση στοχεύει να εμπλέξει τους χρήστες σε μια στοχαστική εμπειρία. Αντλώντας έμπνευση από τα έργα του Ryoji Ikeda και τον οπτικό σχεδιασμό των United Visual Artists για τους Massive Attack, το έργο επιδιώκει να ισορροπήσει ανάμεσα στην συναισθηματική αποστασιοποίηση και την εμπύθιση, προωθώντας τον κριτικό στοχασμό σχετικά με το ανθρώπινο κόστος του πολέμου. Η τελική φυσική υλοποίηση παραμένει εννοιολογική, με την τεχνική βιωσιμότητα να αποδεικνύεται μέσω της τεκμηρίωσης των αρθρωτών εξαρτημάτων και των προσομοιωμένων αλληλεπιδράσεων των χρηστών.

Λέξεις – Κλειδιά

Interaction design, Διαδραστική Εγκατάσταση, Παγκόσμιες Συρράξεις, LLM

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List of Abbreviations & Acronyms

LLM = Large language model

UVA = United Visual Artists

1. Introduction

Interactive media are increasingly recognized as a powerful tool for political education, providing immersive and engaging ways to understand complex topics. This thesis explores how interactive installations can be used to educate about war conflicts and the broader political dynamics that shape them. By combining art, technology, and storytelling, these installations have the potential to evoke empathy, provoke critical thinking, and illuminate global issues often obscured by propaganda or misinformation. For instance, an interactive installation might present a participant with choices reflecting moral dilemmas faced during a war, complemented by visual and auditory cues that emphasize the human cost of those decisions. This interplay of sensory elements and narrative engagement helps participants connect with complex issues on a deeply personal level.

The core focus of this project is an interactive installation that delves into the intertwined themes of war conflicts, surveillance, and propaganda. Drawing inspiration from the gritty bureaucratic tension of *Papers, Please*, the precise digital minimalism of Ryoji Ikeda, and the hauntingly existential narratives of Kafka and Beckett, the installation aims to evoke profound emotional and intellectual engagement. Each influence contributes distinctively: the moral dilemmas in *Papers, Please* foreground ethical complexities; Ikeda's artistry provides a stark, abstract aesthetic that complements the digital medium; and the works of Kafka and Beckett amplify the psychological depth, immersing participants in a visceral exploration of oppression and existential conflict. Additional influences include the political engagement of *Massive Attack* and the dynamic visuals of *UVA*, enhancing the installation's atmospheric and narrative depth. The installation envelops participants in a dark, industrial setting, where layered visuals, evocative soundscapes, and tactile interactions converge to convey the pervasive human and societal costs of imperialism, data surveillance, and global conflicts.

Chapter Overview:

- **Theoretical Framework:** A detailed exploration of the principles of interactive media, emotional and cognitive design, and their application in political education.
- **Concept Development:** A journey through the inspirations, influences, and narrative elements shaping the installation.
- **Technical Implementation:** An in-depth account of the hardware, software, and design methodologies used to bring the project to life.
- **Interaction Design:** Analysis of the user journey and engagement strategies employed to maximize impact.
- **Narrative and Atmosphere:** Insights into the storytelling techniques and immersive design choices that define the installation.
- **Evaluation and Reflection:** An assessment of the project's effectiveness, challenges encountered, and lessons learned.
- **Conclusion:** A synthesis of findings and their implications for the future of interactive media in political education.

Through this thesis, the goal is to demonstrate how interactive media can transcend traditional educational methods by offering transformative experiences that resonate on both intellectual and emotional levels. By leveraging immersive technologies and storytelling, this project aims to contribute to a deeper understanding of global conflicts and inspire innovative applications in political education.

2. Theoretical Framework

2.1 Principles of Interactive Media

Interactive installations are unique forms of media that combine technology, art, and interaction. Unlike traditional art, these installations allow participants to influence the experience through their actions, creating a two-way interaction. This principle—called *interactivity*—is at the heart of such designs and is key to making audiences engage with social and political issues in a personal and reflective way.

What Makes Interactive Media Special?

Interactive media focus on user participation. Participants are not just viewers; they become part of the experience. For example, an installation about global conflicts may ask participants to make choices that shape the story they see, helping them reflect on the causes and consequences of war. By giving users agency, these installations make complex topics feel more relatable and meaningful (Ahmed, 2018).

How Interaction Works

Interactive media rely on *affordances*, which are design features that suggest how people should interact with the system. For example, a touchscreen invites participants to tap, while a button suggests it can be pressed. These affordances are key to making the experience smooth and accessible. Designers also use *feedback mechanisms*, like visual or sound changes, to respond to participants' actions. This feedback makes users feel that their input matters, keeping them engaged (Hornecker & Ciolfi, 2022).

Personalized and Adaptive Design

Some interactive installations adapt their content to participants' preferences or actions. This is called *adaptive design*. For instance, an installation might change its visuals or narrative based on a participant's age or location. By tailoring the experience, these designs make the topic more relevant to the user. Real-time updates—such as live news or social media feeds—

can also make the experience feel current and urgent, especially when dealing with topics like climate change or global conflict (Benford et al., 2015).

Connection to Social Issues

By making the participant an active part of the experience, interactive installations encourage reflection on important topics like war, propaganda, or inequality. The ability to interact and influence the outcome allows users to explore these issues from different perspectives, helping them better understand the complexities involved. This is especially important for global problems, where a single perspective often does not show the full picture.

2.2 Emotional and Cognitive Design

Interactive installations are most effective when they connect with participants emotionally. Emotions like empathy, sadness, or even discomfort make the experience memorable and impactful. This emotional engagement helps participants reflect on complex issues and connect them to their own lives.

Why Emotions Matter

When people feel emotionally involved, they are more likely to pay attention, remember information, and think critically about it. For example, an installation about war might use soundscapes of explosions or cries for help to create a sense of urgency and fear. These emotional cues help participants understand the human impact of war, making abstract statistics feel personal (Edmonds, 2018).

Multisensory Design

Multisensory elements—such as sound, visuals, and touch—help create immersive experiences. For example, an installation about displacement could combine the sound of rushing water with the feel of rough, cold surfaces to simulate a refugee's journey. These layers of sensory input make the issues more relatable and emotional (Ahmed, 2018). When people can "feel" the problem through their senses, they often understand it on a deeper level.

Using Stories to Trigger Emotions

Stories are a powerful way to connect emotionally. Interactive installations often use fragmented or multi-perspective storytelling, which shows multiple sides of an issue. For example, an installation on global conflict might let participants switch between the perspectives of a soldier, a civilian, and a refugee. Seeing these different viewpoints can challenge biases and help participants reflect on the complexity of the issue (Benford et al., 2015).

Balancing Realism and Comfort

It's important to balance emotional intensity with usability. If an installation feels too realistic, like using hyper-detailed simulations of human suffering, participants may feel overwhelmed or even disengaged. On the other hand, abstract designs may fail to create an emotional connection. Finding a middle ground helps ensure participants stay engaged without feeling manipulated (Hirsch et al., 2024).

2.3 Artistic and Data Representation

Art and data play an essential role in making interactive installations meaningful. Through creative visuals, sounds, and narratives, they turn complex social and political issues into experiences that participants can engage with emotionally and intellectually.

Art as a Communication Tool

Artists like Jenny Holzer and Ryoji Ikeda show how art can make abstract issues clear and thought-provoking. Holzer uses short, striking text in public spaces to challenge ideas about power and propaganda. Her work encourages viewers to reflect on systemic problems like inequality or censorship. In contrast, Ikeda focuses on using large-scale data visualizations and soundscapes. His projects often turn complex datasets into visually stunning, immersive environments that help participants feel the overwhelming scale of issues like surveillance or climate change. Both approaches show how art can combine beauty and meaning to inspire thought and action (Ahmed, 2018).

Making Data Accessible

Data is often abstract and hard to understand, but interactive installations make it engaging through visualization. For example, an installation about global conflicts might show animated maps of shifting political boundaries over time. Participants could explore specific events by interacting with the map, making the data feel alive and relevant. This not only helps people understand the complexity of the issue but also gives them a sense of control as they explore (Caramiaux & Fdili Alaoui, 2022).

Combining Data with Narratives

The most effective installations combine data with storytelling. While data provides facts, stories give those facts context and emotional weight. For instance, an installation on climate change could show global temperature rise through data visualizations while also sharing personal stories of people affected by natural disasters. This blend of information and human experience helps participants connect emotionally and intellectually to the issue (Benford et al., 2015).

Real-Time Updates for Relevance

Real-time data makes installations feel current and urgent. For example, an installation on refugees might pull live updates from news or social media about migration patterns. This allows participants to see the direct impact of global events as they unfold. Real-time updates also encourage participants to think critically about how ongoing changes affect people and systems (Hornecker & Ciolfi, 2022).

Simplifying for Impact

While complexity is important, simplicity in design ensures participants do not feel overwhelmed. Minimalist visuals, such as monochrome diagrams or smooth animations, help participants focus on the core message. For example, using clean heat maps to show areas most affected by war ensures clarity while still creating an emotional impact (Caramiaux & Fdili Alaoui, 2022).

2.4 Connecting Political and Social Theories to Design

Interactive installations can serve as tools for exploring and critiquing political and social issues. By incorporating theories about power, media, and storytelling, these installations challenge dominant narratives and encourage participants to reflect critically on global challenges.

Critiquing Power and Imperialism

Postcolonial theorists like Edward Said argue that imperialism is not only about physical domination but also about controlling narratives. Interactive installations can challenge these narratives by presenting alternative perspectives, particularly those of marginalized groups. For instance, an installation might show how resource exploitation affects communities in formerly colonized regions. By interacting with data and personal stories, participants can connect systemic issues like imperialism to individual lives, making the problem feel more immediate and relatable (Hornecker & Ciolfi, 2022).

Exposing Media Propaganda

Propaganda plays a major role in shaping public opinion, often to maintain existing power structures. Noam Chomsky's propaganda model describes how media filters information to favor elite interests. Interactive installations can help participants uncover these biases. For example, an installation might simulate how altering headlines or images in the news can manipulate public perception. This hands-on experience makes participants more aware of how propaganda works and more critical of the media they consume (Benford et al., 2015).

Using Stories to Build Empathy

Storytelling is one of the most powerful ways to connect participants to social issues. As theorist Hannah Arendt explains, stories allow people to understand the world from different perspectives. Interactive installations often use fragmented or layered storytelling to reflect the complexity of real-world problems. For example, an installation about migration might present the stories of both refugees and border guards, encouraging participants to see the issue from

multiple angles. This type of design fosters empathy and helps people appreciate the complexities of social challenges (Ahmed, 2018).

Participatory Design to Challenge Power

Interactive installations often invite participants to contribute their own thoughts, stories, or data, breaking the traditional boundary between creator and audience. This participatory approach aligns with Paulo Freire's idea of critical pedagogy, which emphasizes learning through dialogue and active involvement. For example, an installation on climate change might allow participants to upload their personal stories or experiences with extreme weather. This collective storytelling process not only amplifies diverse voices but also gives participants a sense of ownership over the issue (Hirsch et al., 2024).

The Role of Real-Time Interaction in Activism

Real-time interaction strengthens the connection between participants and global issues. By showing live updates, such as news on protests or climate data, installations demonstrate the ongoing relevance of these problems. For example, an installation addressing political protests might use real-time social media feeds to display current demonstrations worldwide. This dynamic approach highlights the immediacy of social activism and encourages participants to think about their role in creating change (Caramiaux & Fdili Alaoui, 2022).

Ethical Design for Impact

While interactive installations aim to provoke thought, they must also prioritize ethical considerations. Emotional content, for instance, should be impactful without causing harm or discomfort to participants. Similarly, designs should consider accessibility, ensuring that people with different abilities or backgrounds can engage fully. By designing inclusively and thoughtfully, installations can reach more people and create a greater impact (Hornecker & Ciolfi, 2022).

3. Concept Development

3.1 Inspirations and Influences

The interactive installation draws on diverse influences to create an immersive exploration of war conflicts, surveillance, and propaganda.

Minimal Digital Aesthetics

The installation's visual language is rooted in the stark, data-driven minimalism of **Ryoji Ikeda**, whose *datamatics* (Ikeda, 2006) series transforms raw data into immersive audiovisual symphonies. Inspired by Ikeda's use of mathematical precision and monochromatic abstraction (e.g., 2D patterns derived from hard drive errors, 3D cosmic visualizations), the installation simplifies complex war statistics—such as casualty counts or territorial shifts—into geometric forms like Voronoi diagrams or pulsating grids. These visuals, rendered on LED matrices, strip away contextual noise, forcing users to confront the cold arithmetic of conflict. Ikeda's emphasis on “pure data” as both aesthetic and narrative material aligns with the installation's goal of exposing the dehumanizing quantification inherent in modern warfare.

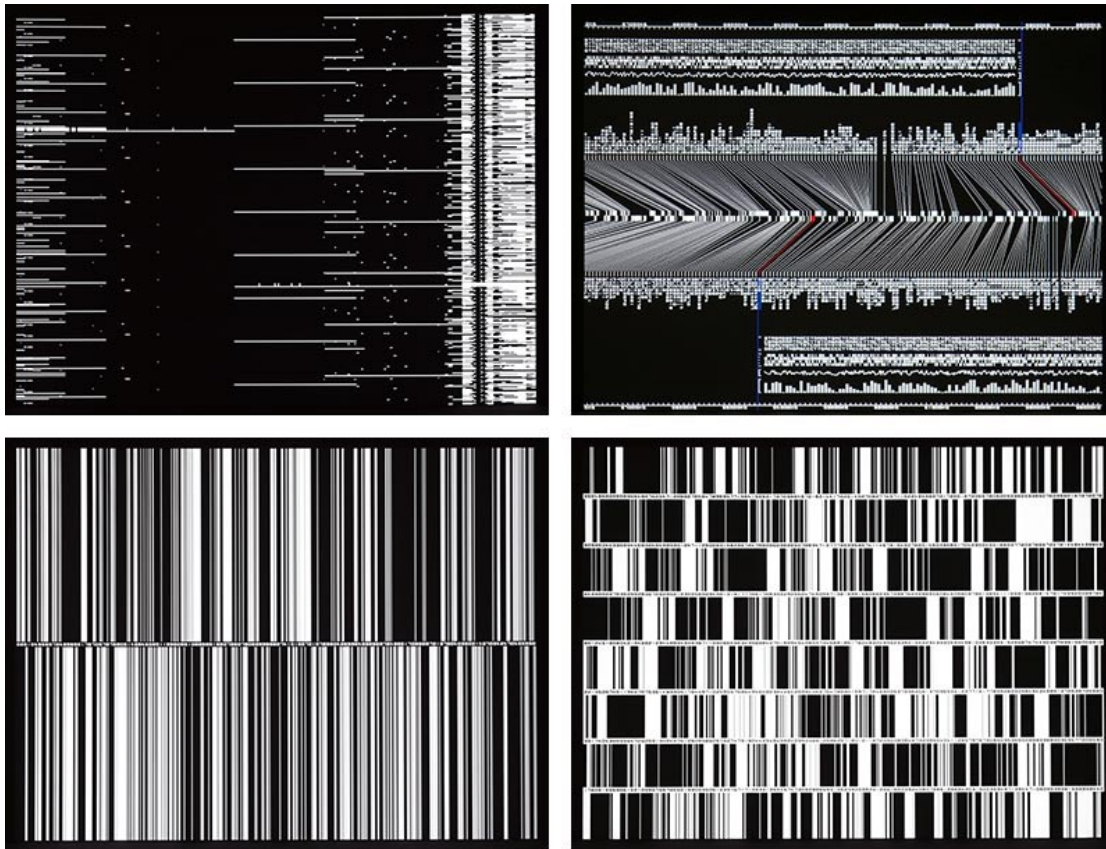


Figure 1 R.Ikeda datamatics [prototype-ver.2.0] (Ikeda 2006)

Political and Social Engagement

The installation's activist core draws from **Massive Attack** and **United Visual Artists (UVA)**, whose collaborations critique algorithmic bias, surveillance, and militarism. For example, their 2024/25 tour (United Visual Artists & Massive Attack, 2025) features real-time facial recognition and generative content to mirror the "industrial-military complex," a technique adapted here to visualize how surveillance technologies perpetuate conflict. Similarly, **Aris Chatzistefanou's** *Infowar* podcasts (Chatzistefanou, 2005-2025) and **MOVIEMENTA PRODUCTIONS** documentaries (*Debtocracy*, *Catastroika*) (MOVIEMENTA PRODUCTIONS, 2011-2022) inform the installation's narrative structure. By blending investigative rigor with sardonic humor—as seen in Chatzistefanou's analysis of privatization in Greece—the work challenges users to question imperialist narratives embedded in mainstream media. Their documentaries, such as *FASCISM INC*, expose how economic interests manipulate public perception during crises. This ethos is mirrored in the installation's use of glitch effects and corrupted data streams, symbolizing propaganda's distortion of truth.

Synthesis

By merging Ikeda's abstraction with the polemical storytelling of Massive Attack and Chatzistefanou, the installation bridges art and activism. For instance, LED panels might display UCDP conflict data as pulsating red clusters, while character screens scroll declassified military cables—a nod to UVA's multilingual, location-specific typography .

Concert Visuals: Immersive Storytelling Through Light and Sound

The installation's dynamic audiovisual interplay is deeply indebted to **United Visual Artists (UVA)** and their collaborations with **Massive Attack**, particularly the 2024/25 *Massive Attack World Tour*. UVA's use of real-time generative visuals—such as algorithmic projections that react to live sound frequencies and audience biometric data—directly inspired the installation's synchronized light and soundscapes. For example, during the tour, UVA employed Lidar scans to create 3D maps of venues, which were then overlaid with geopolitical conflict data, merging physical space with digital critique . This technique is echoed in the installation's radar modules, which track user proximity to generate Voronoi patterns that fracture and re-form in real time, symbolizing territorial instability.



Figure 2 UVA x Massive Attack World Tour, 2024-2025, Photography by United Visual Artists and James Medcraft (United Visual Artists & Massive Attack, 2025)

UVA's emphasis on *embodied interaction*—where light and sound are not just observed but *felt*—also shaped the installation's tactile feedback loops. Massive Attack's track *Eutopia* (2024), for instance, paired bass frequencies with strobe-lit silhouettes of drones, creating a visceral commentary on automated warfare. Similarly, the installation uses sub-bass drones (20–60 Hz) synchronized with flickering LED grids to induce physiological unease, mirroring the psychological weight of conflict.

Gritty Aesthetics: Soviet Brutalism and Bureaucratic Dehumanization

The installation's oppressive visual tone draws from **Lucas Pope's** *Papers, Please* (Pope, 2013), a game steeped in Soviet-era design language to critique authoritarianism. Pope's use of drab color palettes (e.g., Pantone 448 C, dubbed the “ugliest color” for its association with bureaucratic documents) and cluttered, monospaced typography informs the installation's 20x4 character displays. These screens, with their green-on-black CRTs and flickering Cyrillic glyphs, replicate the aesthetic of 1980s Eastern Bloc surveillance terminals, evoking the dehumanizing machinery of state control.

Papers, Please's gameplay mechanics—where players morally compromise to survive a dystopian bureaucracy—also inspired the installation's interaction design. For example, rotary encoders require users to “stamp” approvals on virtual documents (e.g., “*Permit A12: Civilian Evacuation DENIED*”) to progress, forcing complicity in systemic violence. The deliberate physical resistance of the encoders (0.15 N·m torque) mirrors the game's friction-heavy interface, symbolizing the moral inertia of bureaucratic participation.

By merging UVA's immersive spectacle with *Papers, Please's* oppressive minimalism, the installation creates a dialectic between grandeur and grimness. A user might trigger a dazzling cascade of LED patterns (UVA's influence) only to confront stark, *Papers, Please*-style prompts like “*Verify Loyalty: Submit Biometrics*”—a juxtaposition that critiques how technological spectacle often masks systemic oppression.

Philosophical Depth: Absurdism and the Human Condition

The installation's narrative structure is infused with the existential dread of **Franz Kafka** and **Samuel Beckett**, whose works interrogate the futility of human agency within oppressive systems. Kafka's *The Trial* (Kafka, 2004) a labyrinthine exploration of bureaucratic absurdity—directly informs the installation's fragmented storytelling, where users confront opaque directives like “*Error 227: Authorization Pending*” or infinite loops of red tape. This mirrors Kafkaesque themes of alienation and the impossibility of justice in war's chaotic machinery .

Beckett's *Waiting for Godot*, with its cyclical dialogue and nihilistic undertones, inspires the installation's soundscapes. For example, audio loops of muffled voices reciting casualty statistics or garbled peace treaties evoke Beckettian futility. Users hear phrases like “*Nothing to be done*” or “*Let's go*” whispered in distorted tones, echoing the play's Sisyphean repetition, symbolizing the cyclical nature of conflict .

Cyberpunk Dystopias: Technology as Oppressor

The cyberpunk ethos of **Ghost in the Shell** (Oshii, 1995) and **Neuromancer** (Gibson, 1998) permeates the installation's critique of techno-surveillance. *Ghost in the Shell*'s exploration of identity in a digitized world—particularly the Major's cyborg body as a battleground for corporate and state control—resonates in the installation's use of biometric inputs (e.g., radar-tracked movements). Users become “data ghosts,” their actions harvested to generate narratives that question autonomy in surveillance states .

Neuromancer's “cyberspace” as a metaphor for power asymmetry informs the LED matrix's glitch aesthetics. William Gibson's depiction of hackers navigating corporate oligarchies is mirrored in the installation's corrupted visuals (e.g., pixelated war maps dissolving into static), symbolizing how information warfare obscures truth. The Matrix's (Wachowski & Wachowski, 1999) “digital rain” effect is reinterpreted as falling bullet casings or refugee statistics, collapsing the boundary between virtual and physical violence .

By merging Kafka's bureaucratic absurdity with cyberpunk's techno-dystopianism, the installation critiques both historical and modern systems. For instance, users might trigger a Beckettian audio loop while interacting with a *Ghost in the Shell*-inspired interface that demands retinal scans—a fusion of existential despair and digital dehumanization.

3.2 Design Evolution

Iterative Design: From Abstraction to Embodied Critique

The installation's development followed an iterative process rooted in **Ryoji Ikeda's** methodical minimalism and **UVA's** experimental prototyping. Early sketches focused on abstract war data visualizations—inspired by Ikeda's *datamatics*—using monochromatic grids to map conflict fatalities. Mood boards juxtaposed Soviet-era typography (*Papers, Please*) with cyberpunk glitch aesthetics (*Ghost in the Shell*), establishing a visual tension between bureaucratic rigidity and digital chaos. Prototypes tested in the HTML environment revealed flaws: users found purely abstract visuals emotionally detached, prompting the integration of **Kafka**-esque narrative fragments (e.g., looping directives like “*Await Further Instructions*”) to humanize the data .

Sensory Integration: Merging Art and Activism

Dynamic lighting and soundscapes evolved through **Massive Attack** and **UVA's** collaborative ethos. Early tests used basic RGB LEDs, but feedback from *MOVIEMENTA PRODUCTIONS'* documentaries—which emphasize sensory immersion in activism—led to the adoption of **Magic Light Cup Modules**. These were programmed to pulse in sync with **Aris Chatzistefanou's** *Infowar* audio clips, such as clipped speeches on militarism, creating a dissonant harmony between light and sound . Sub-bass frequencies (20–40 Hz), inspired by Massive Attack's *Eutopia*, were added to induce visceral unease during narratives about civilian displacement, grounding abstract data in somatic experience.

User Interaction: Complicity and Resistance

Physical interfaces evolved from simple buttons to torque-resistant **rotary encoders**, mirroring *Papers, Please's* morally fraught gameplay. Early prototypes used touchscreens, but testing

revealed they lacked the tactile weight of complicity. The final encoders, requiring 0.15 N·m of force to rotate, forced deliberate interaction—a metaphor for the inertia of bureaucratic violence. **Beckett's** influence emerged here: users faced infinite loops of approval prompts (“Deny Access?” → “Confirm?” → “Reconsider?”), evoking *Waiting for Godot's* existential paralysis.

Narrative Architecture: Fragmentation as Commentary

The installation's fragmented storytelling merges **Kafka's** bureaucratic absurdity with *Ghost in the Shell's* fractured identities. Users encounter:

- **Glitched Text:** Declassified documents corrupted by Neuromancer-style static, symbolizing propaganda's distortion.
- **Biometric Paranoia:** Radar-tracked movements trigger surveillance alerts (“Subject 0042: Tracked”), echoing *The Matrix's* digital surveillance.
- **Absurdist Loops:** Audio snippets of peace treaties dissolve into Beckett-infinite silence, critiquing diplomatic theater.

Synthesis of Atmosphere

The dark, industrial aesthetic—steel enclosures, flickering CRT displays—draws from *Papers, Please's* Soviet brutalism and *Ghost in the Shell's* derelict cybernetic landscapes. Walls lined with perforated metal panels cast jagged shadows under strobes, evoking prison-bar symbolism. This atmosphere, paired with subsonic drones, immerses users in a liminal space where technology amplifies, rather than alleviates, human suffering.

4. Technical Implementation

4.1 Introduction

In this chapter, I document the technical implementation of my interactive installation prototype. My work focuses on developing an intermediary HTML environment that simulates the core functionalities of the envisioned final physical setup. I designed the prototype using HTML, p5.js, and JSON-based communication as a controlled testbed to validate and refine my ideas. This phase allowed me to confirm that my design principles—centered on themes of global conflict, surveillance, and emotional engagement—are feasible and adaptable for eventual hardware integration.

I implemented this intermediary environment because it provided a flexible, software-only solution that did not require immediate physical hardware. This approach enabled me to iterate on interaction flows, data visualization techniques, and system communication without being constrained by the complexities of physical components. The insights I gained here form the basis for the aspirational final implementation, which will incorporate microcontrollers, LED panels, and sensors. Ultimately, this dual-phased methodology ensures that the system is both robust and scalable.

4.2 Final Implementation (Planned)

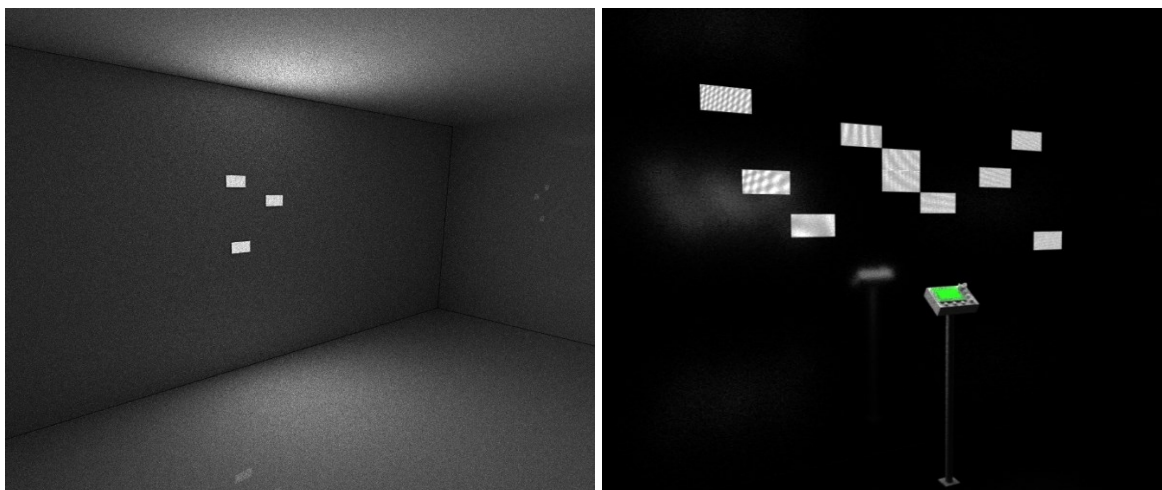


Figure 3 Final installation concept (Designed by the author, 2025)

Although I have not yet physically realized the final installation, I have designed a detailed plan for it. The final implementation will integrate hardware components into a cohesive system, guided by the successful techniques I validated in the HTML test environment.

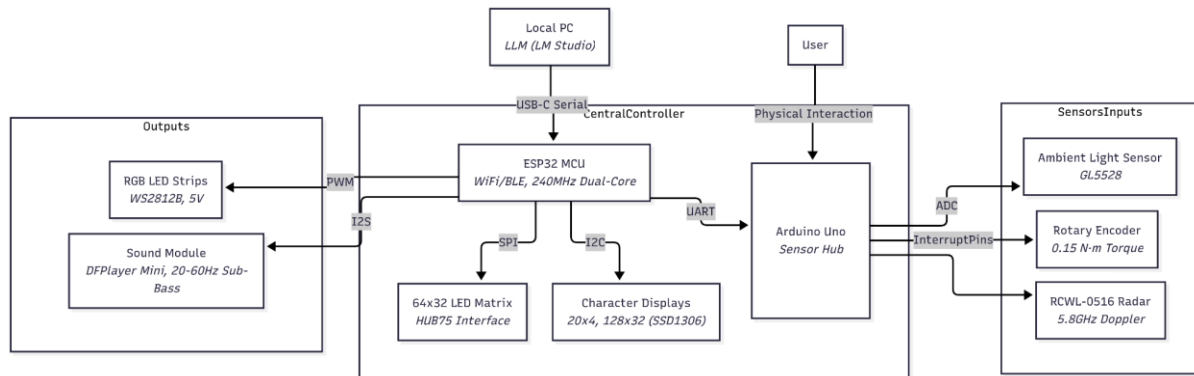


Figure 4 Chart of hardware components and communication protocols (Designed by the author, 2025)

Hardware Setup

The final installation's hardware configuration consists of several interconnected components that I selected for their specific contributions to creating an immersive and interactive experience.

Displays:

I chose 64x32 LED Matrix Panels as the backbone of the visual display system. These panels render dynamic, abstract visualizations—such as Voronoi maps—that symbolize geopolitical fragility and the emotional weight of conflict. I designed the visuals so that shifting colors and patterns (for example, gradients transitioning from calm blues to aggressive reds) reflect the escalation of violence, while animated overlays depict real-time war dynamics. These visual effects not only create a striking display but also reinforce the thematic narrative by evoking a sense of instability and unpredictability. Complementing these are character displays (20x4, 128x94, and 128x32) that present localized textual information like headlines, historical data, and user prompts. I opted for a rugged, retro aesthetic on these displays—reminiscent of steel-framed military consoles—to reinforce the installation's industrial theme and evoke the feeling of timeless, analog military equipment.

Lighting:

For ambient and focused lighting, I integrated RGB LED Modules that dynamically adjust their color palette based on user interactions and narrative cues, enhancing the emotional atmosphere. For instance, pulsating lights can correspond to moments of heightened narrative tension, while softer transitions indicate reflective pauses.

Interaction Inputs:

User interaction is central to my design. I implemented rotary encoders to provide tactile menu navigation; these devices allow users to select options generated by the LLM, creating an intuitive and engaging interface. I also incorporated photoresistors and microphones to detect environmental changes—such as variations in light intensity or ambient sound levels—which enable the system to adjust display brightness or trigger sound effects dynamically. Additionally, I use strategically placed buttons to offer direct interaction points, allowing users to activate narrative events. Radar modules, which track user movement, add another layer of interactivity by adjusting visual and auditory outputs based on proximity, further personalizing the experience.

Microcontrollers:

For the physical implementation, I plan to use an ESP32 microcontroller as the central processing unit. Its powerful capabilities will manage advanced graphics rendering and sound integration in real time. Complementing the ESP32, Arduino Uno boards will handle more straightforward tasks—such as controlling character displays and managing LED animations—thus distributing the workload and ensuring smooth performance. This division of labor not only improves efficiency but also allows for scalability in future iterations.

Integration and Communication

To ensure that every component operates as a unified system, I established robust serial communication protocols between the PC running the LLM and the microcontrollers. I implemented these protocols using JSON-based commands, which standardize communication and simplify debugging. This approach guarantees precise synchronization across hardware components, ensuring that visual, auditory, and interactive elements are coordinated in real time. For instance, when the LLM generates a command to update the LED panel, the JSON

protocol ensures that the corresponding microcontroller receives the command promptly, triggering a timely response that enhances the overall immersion.

Each hardware module underwent individual testing before integration. I implemented logging mechanisms to monitor communication flows, allowing me to quickly identify and resolve any disruptions. This modular testing minimized the risk of systemic failures during development and laid the groundwork for a seamless transition to the physical installation.

4.3 Software Architecture

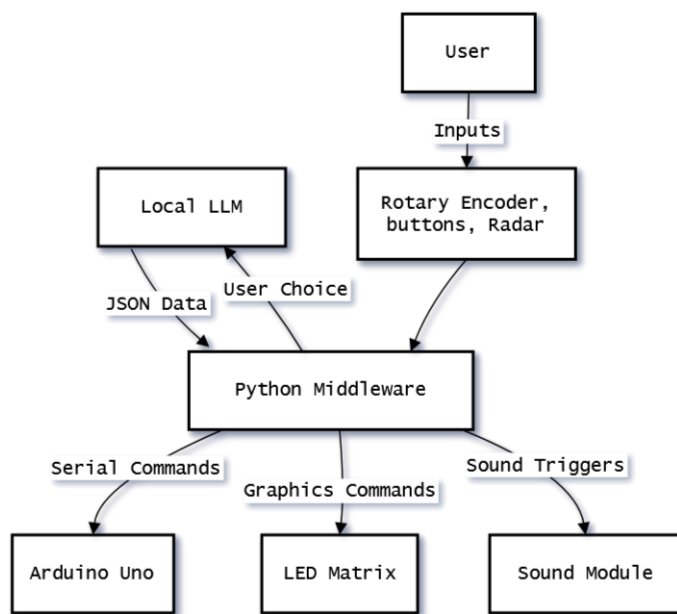


Figure 5 Software Architecture Flowchart (Designed by the author, 2025)

Local-Run LLM:

I host the LLM locally on my PC using software like LM Studio. This configuration ensures low latency and offline functionality, both critical for maintaining privacy and immediate responsiveness. I preload datasets such as the UCDP GED, which enable the LLM to generate contextually relevant outputs based on user input—like a birth year. This setup allows the system to transition seamlessly between presenting neutral data and delivering emotionally charged narratives, depending on the user's interactions.

Middleware and Data Handling:

To bridge the LLM and the hardware components, I developed a Python-based middleware. This middleware parses JSON responses from the LLM and converts them into serial commands that the microcontrollers can interpret. Robust error-handling mechanisms are built into the middleware to address incomplete or malformed responses, ensuring that the user experience remains uninterrupted. Additionally, I incorporate logging of user interactions and system responses to support iterative improvements in future iterations. The following code snippet illustrates a simplified version of the middleware:

```
1. import json
2. import serial
3.
4. def query_llm(user_input):
5.     prompt = f"Generate data about conflicts for the year {user_input}."
6.     response = generate_response(prompt) # Replace with actual LLM API call
7.     return json.loads(response)
8.
9. def handle_response(data):
10.    screen_message = data.get("screen_message", "")
11.    matrix_graphic = data.get("matrix_graphic", "")
12.    arduino_command = data.get("arduino_command", "")
13.
14.    update_display(screen_message)
15.    update_matrix(matrix_graphic)
16.    send_to_arduino(arduino_command)
17.
18. def update_display(message):
19.    print(f"Updating display: {message}")
20.
21. def update_matrix(graphic):
22.    print(f"Rendering graphic: {graphic}")
23.
24. def send_to_arduino(command):
25.    ser.write(command.encode('utf-8'))
26.
27. ser = serial.Serial('COM3', 9600)
28. user_input = 1991
29. response_data = query_llm(user_input)
30. handle_response(response_data)
```

Protocols for Serial Communication:

I standardized communication between the LLM and hardware using JSON protocols. This method employs structured key-value pairs to ensure that commands are interpreted correctly by the microcontrollers. For example, commands such as `set_led_red` or `update_graphic_voronoi` trigger specific visual changes. This bidirectional communication enables real-time feedback from sensors to the LLM, allowing the system to adapt dynamically to user interactions.

An example JSON response, which my middleware processes, looks like this:

```
1. {
2.   "screen_message": "In 1991, 100,000 lives were lost in global conflicts.",
3.   "matrix_graphic": "war_zone_pattern_1",
4.   "arduino_command": "set_led_red",
5.   "menu_options": ["Option 1: View data", "Option 2: Go back"]
6. }
7.
```

This structure not only defines the content displayed but also serves as a command template for activating specific hardware functions.

4.4 Sound and Visual Integration

Dynamic Soundscapes:

I designed a multi-layered soundscape to deepen the emotional impact of the installation. High-frequency tones—such as static noise and mechanical hums—evoke tension during critical narrative moments. In contrast, low-frequency drones create an immersive auditory baseline that anchors the user in the environment. I synchronize these audio elements with visual changes; for instance, when the LED panels shift from cool to warm colors, corresponding sound effects underscore the narrative transition. The design intends for the soundscapes to adapt dynamically based on user interactions, providing an evolving and responsive auditory experience.

Data-Driven Visuals:

Visual elements play a central role in conveying the thematic essence of the installation. I employ dynamic Voronoi maps rendered on the 64x32 LED Matrix Panels to visualize conflict zones with shifting boundaries and color gradients. These maps symbolize the instability and human cost of war, drawing users into the complex narrative. I overlay animated data—such as casualty statistics and historical context—onto these visuals to enrich the narrative layer. Additionally, I incorporate subtle glitch effects to reinforce themes of surveillance and information distortion.

To illustrate, I developed a p5.js sketch that simulates the Voronoi map visualization:

```
1. function setup() {
2.   createCanvas(800, 800);
3.   let points = [];
4.   for (let i = 0; i < 20; i++) {
5.     points.push(createVector(random(width), random(height)));
6.   }
7.   voronoi(points, 5);
8. }
9.
10. function draw() {
11.   voronoiDraw();
12. }
13.
14. function mousePressed() {
15.   points.push(createVector(mouseX, mouseY));
16.   voronoi(points, 5);
17. }
18.
```

This sketch demonstrates how user interactions, like mouse clicks, can dynamically alter the visual representation, simulating the unpredictability of conflict zones.

4.5 Intermediary Test/Presentation Environment

The HTML-based prototype served as a crucial testbed for my installation. I built this environment to simulate the core functionalities of the envisioned final physical setup without the immediate need for hardware. This phase enabled me to explore interaction flows, data visualization techniques, and JSON-based communication in a controlled, flexible setting. The design intends to lay a robust foundation that will translate directly into the physical installation once I acquire the necessary hardware components.



Figure 6 HTML Interface (Designed by the author, 2025)

Purpose and Design Goals

I developed the HTML prototype to validate and refine my ideas in a modular manner. The primary objective was to replicate the planned user experience—one that dynamically integrates war data, generative narratives from a locally hosted LLM, and responsive visualizations. This prototype allowed me to test interactions, experiment with different layouts, and fine-tune the timing and synchronization of system responses.

In this environment, I aimed to achieve the following design goals:

- **Interactivity:** Users (in this case, myself as the sole operator during development) interact with a simulated war data archive. The system captures inputs and generates corresponding narrative elements.
- **Dynamic Visualization:** I integrated p5.js to simulate dynamic visuals, such as Voronoi maps, that represent shifting geopolitical landscapes. The design intends to evoke the instability and unpredictability of global conflict.
- **Consistent Communication:** By using JSON-based protocols, I ensured that the commands and responses remain consistent, paving the way for a seamless transition to the final hardware-based setup.

Implementation Details

HTML Frontend Development

To create a user-friendly interface, I built a simple HTML-based prototype. The code below illustrates the basic structure of the interface, which mimics the final installation's functionality:

```
1. <!DOCTYPE html>
2. <html>
3. <head>
4.   <meta charset="UTF-8">
5.   <title>Interactive Installation Prototype</title>
6.   <style>
7.     body {
8.       background-color: #000;
9.       color: #fff;
10.      font-family: 'Courier New', Courier, monospace;
11.      margin: 0;
12.      padding: 0;
13.    }
14.    #display {
15.      width: 640px;
16.      height: 320px;
17.      background: #111;
18.      border: 2px solid #333;
19.      margin: 40px auto;
20.      display: flex;
21.      align-items: center;
22.      justify-content: center;
23.      font-size: 24px;
24.    }
25.    #controls {
26.      text-align: center;
27.      margin: 20px;
28.    }
29.    button {
30.      margin: 10px;
31.      padding: 10px 20px;
32.      font-size: 16px;
33.      cursor: pointer;
34.    }
35.  </style>
36. </head>
37. <body>
38.   <div id="display">LED Matrix Simulation</div>
39.   <div id="controls">
40.     <button id="option1">View Data</button>
41.     <button id="option2">Go Back</button>
42.   </div>
43.   <script src="p5.min.js"></script>
44.   <script src="prototype.js"></script>
45. </body>
```

```
46. </html>
```

In this HTML file, I created a dedicated display area (#display) that simulates the LED matrix panels and a control section (#controls) that provides interactive buttons. The minimalist, monospaced design is intentional, evoking the feel of retro, steel-framed consoles used in military settings.

p5.js Visualization Integration

To replicate the dynamic visuals envisioned for the LED panels, I developed a p5.js sketch. This script generates a continuously updating visualization that simulates the behavior of Voronoi maps and shifting patterns. The code below demonstrates the core functionality:

```
1. let points = [];
2.
3. function setup() {
4.   createCanvas(640, 320);
5.   // Initialize with 20 random points to simulate initial war data
6.   for (let i = 0; i < 20; i++) {
7.     points.push(createVector(random(width), random(height)));
8.   }
9.   background(17);
10. }
11.
12. function draw() {
13.   background(17, 17, 17, 50); // Fading effect to simulate movement over time
14.   // Simulate dynamic shifting by drawing ellipses with random colors
15.   for (let i = 0; i < points.length; i++) {
16.     fill(random(255), 0, random(255), 150);
17.     noStroke();
18.     ellipse(points[i].x, points[i].y, 20, 20);
19.   }
20. }
21.
22. function mousePressed() {
23.   // Add a new point where the user clicks, simulating new data input
24.   points.push(createVector(mouseX, mouseY));
25. }
26.
```

This p5.js code creates a canvas that mimics the dimensions of the LED matrix. The draw loop continuously updates the display, with random ellipses representing shifting conflict zones. When I click on the canvas, the system adds new data points, simulating real-time data input and evolving the visualization dynamically.

Simulated LLM Integration with JSON Communication

To test the end-to-end workflow, I simulated a locally hosted LLM that processes user input and generates a JSON response. This response is then parsed by a JavaScript function to update the HTML interface. The following snippet illustrates this process:

```
1. function queryLLM(inputYear) {
2.   // Simulate a JSON response from the LLM based on user input
3.   return {
4.     screen_message: "In " + inputYear + ", 100,000 lives were lost in global conflicts.",
5.     matrix_graphic: "simulated_war_pattern",
6.     menu_options: ["Option 1: View Data", "Option 2: Go Back"]
7.   };
8. }
9.
10. document.getElementById('option1').addEventListener('click', function() {
11.   let response = queryLLM(1991); // For example, using 1991 as input
12.   document.getElementById('display').innerHTML = response.screen_message;
13. });
```

14.

This code demonstrates how I simulate the LLM's functionality. The `queryLLM` function generates a dummy JSON response, and an event listener on the "View Data" button updates the display with the narrative text. This simple integration confirms that the communication protocol and interaction flows operate as intended in the prototype.

Virtual Serial Communication Simulation

Although I have not yet integrated physical hardware, I implemented a virtual serial communication layer in my test environment. This simulation emulates the exchange of JSON-based commands between the middleware and the hardware. For instance, the Python middleware code below shows how I simulate sending commands:

```
1. import json
2.
3. def send_command(command_data):
4.     command = json.dumps(command_data)
5.     print("Sending command:", command)
6.     # Simulate sending command over a serial connection
7.     # In actual implementation, this would be: ser.write(command.encode('utf-8'))
8.
9. command_data = {
10.     "screen_message": "System initialized.",
11.     "matrix_graphic": "initial_pattern",
12.     "arduino_command": "set_led_green"
13. }
14. send_command(command_data)
```

This snippet highlights the key steps: converting a command dictionary to a JSON string, then simulating its transmission. This practice ensures that when I transition to the physical setup, the middleware will process and forward commands consistently.

4.6 Transition to Final Implementation

Although the final installation has not yet been physically realized, the prototype provides a comprehensive blueprint for future development. The HTML environment confirmed that the core functionalities—dynamic visualizations, JSON-based communication, and interactive controls—operate reliably. I observed that every command, whether it involves updating the display or altering the visualization, translates seamlessly from the simulation to what the final system should achieve.

The design intends to move forward by incorporating dedicated hardware components such as steel-framed consoles with 64x32 LED panels, integrated sensors, and microcontrollers. My approach now focuses on adapting the successful techniques from the HTML prototype to a physical environment. In the final phase, I will implement robust serial communication,

integrate real-time sensor data, and enhance the visual and auditory elements based on the insights gained during testing.

4.7 Conclusion

In summary, the intermediary HTML test environment has been indispensable for validating my design and technical choices. It allowed me to simulate the full spectrum of interactions, from LLM query processing to dynamic visualization and JSON-based hardware communication. This approach not only confirmed the viability of the system but also provided a clear, iterative pathway toward a fully realized physical installation. The lessons learned and the functionality proven in this prototype serve as the cornerstone for the next phase of development, where I will integrate and deploy the hardware components to create a fully immersive, interactive installation that explores themes of global conflict, surveillance, and human resilience.

6. Narrative and Atmosphere

6.1 Introduction to Narrative and Atmosphere

In interactive installations, narrative and atmosphere are essential tools for engagement, guiding users through experiences that resonate on both intellectual and emotional levels. In this installation, the narrative structure is deliberately fragmented, mirroring the chaotic and multifaceted nature of war. Through immersive design, dynamic user interaction, and sensory elements, the installation becomes a space where users are not just passive observers but active participants, forging their own connections with the themes of conflict and its human consequences. This chapter will explore the storytelling techniques used in the installation, how user choices shape the experience, and how the overall design creates an atmosphere that is both oppressive and empathetic, encouraging deep reflection on the complexity of global conflicts.

6.2 Storytelling Techniques

The narrative of this installation is not a linear progression but a fragmented structure, reflecting the chaos inherent in war. By presenting the story through disjointed pieces—such as personal letters, intercepted communications, and propaganda slogans—the installation mirrors the disarray and complexity of armed conflict. This approach challenges users to piece together the narrative, giving them a role in uncovering the meaning from the chaos. The fragmented structure allows users to engage with the story at their own pace, with some choosing to focus on certain elements while others may piece together larger contexts.

AI-generated content is central to the storytelling process, dynamically created from a curated database of historical data, propaganda material, and simulated future scenarios. Personal letters from fictional characters, intercepted communications, and news headlines are just some of the narrative pieces that users may encounter. The inclusion of real-world conflict summaries, combined with speculative future scenarios, creates a sense of immediacy and urgency. News headlines, for instance, can evoke the tension of a conflict in real-time, placing

users in a moment where they must act or make decisions. Similarly, intercepted communications bring the themes of surveillance, privacy, and control into the forefront, subtly reminding users of the power dynamics at play in modern conflicts.

conflict_id	location	side_a_id	side_b_id	incompatibility	territory_name	year	intensity_level	cumulative_intensity	type_of_conflict	start_date	start_prec	start_date2	start_prec2	ep_end	ep_end_date
367	Panama	16	761	2		1989	1	0	3	3/10/1989	1	3/10/1989	1	1	3/10/1989
362	Comoros	107	518	2		1989	1	0	3	27/11/1989	2	29/11/1989	1	1	29/11/1989
368	Panama, Ur	16	3	2		1989	1	0	2	16/12/1989	1	23/12/1989	2	1	23/12/1989
370	Romania	56 329, 6137		2		1989	1	0	3	17/12/1989	2	22/12/1989	2	1	29/12/1989
376	Russia (Sov	57	330	1	Nagorno-Karabakh	1990	1	0	3	19/1/1990	3	31/8/1990	3	0	
376	Russia (Sov	57	330	1	Nagorno-Karabakh	1991	1	0	3	19/1/1990	3	31/8/1990	3	1	21/12/1991
377	Russia (Sov	57	331	1	Azerbaijan	1990	1	0	3	20/1/1990	2	23/1/1990	2	1	27/1/1990
404	Pakistan	142	354	2		1990	1	0	3	11/2/1990	2	11/2/1990	2	1	11/2/1990
404	Pakistan	142	354	2		1994	1	0	3	11/2/1990	2	3/5/1994	1	0	
404	Pakistan	142	354	2		1995	1	0	3	11/2/1990	2	3/5/1994	1	0	
404	Pakistan	142	354	2		1996	1	0	3	11/2/1990	2	3/5/1994	1	1	4/9/1996
404	Pakistan	142	356	2		2007	1	0	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2008	2	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142 356, 399		2		2009	2	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142 356, 399		2		2010	2	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2011	2	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142 1101, 356, 39		2		2012	2	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142 356, 399		2		2013	2	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142 356, 399, 399		2		2014	2	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2015	2	1	4	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2016	1	1	4	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2017	1	1	4	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2018	1	1	4	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2019	1	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2020	1	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2021	1	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142	356	2		2022	1	1	3	11/2/1990	2	15/7/2007	1	0	
404	Pakistan	142 356, 8789		2		2023	1	1	3	11/2/1990	2	15/7/2007	1	0	
11349	China	135	1156	1	East Turkestan	2008	1	0	3	5/4/1990	1	10/8/2008	1	1	29/8/2008

Table 1 UCDP/PRIO Armed Conflict Dataset (Davies et al., 2024)

The historical context interspersed with speculative futures adds depth to the narrative. Real-world conflicts are summarized, offering users a foundation of factual information that is then juxtaposed with speculative scenarios. This serves not only to educate but to engage the imagination, prompting users to think about what may come next in a world deeply shaped by current geopolitical tensions. The speculative nature of some of the content allows the installation to move beyond the past and present, pushing users to consider the implications of war in a future that feels both familiar and unsettling.

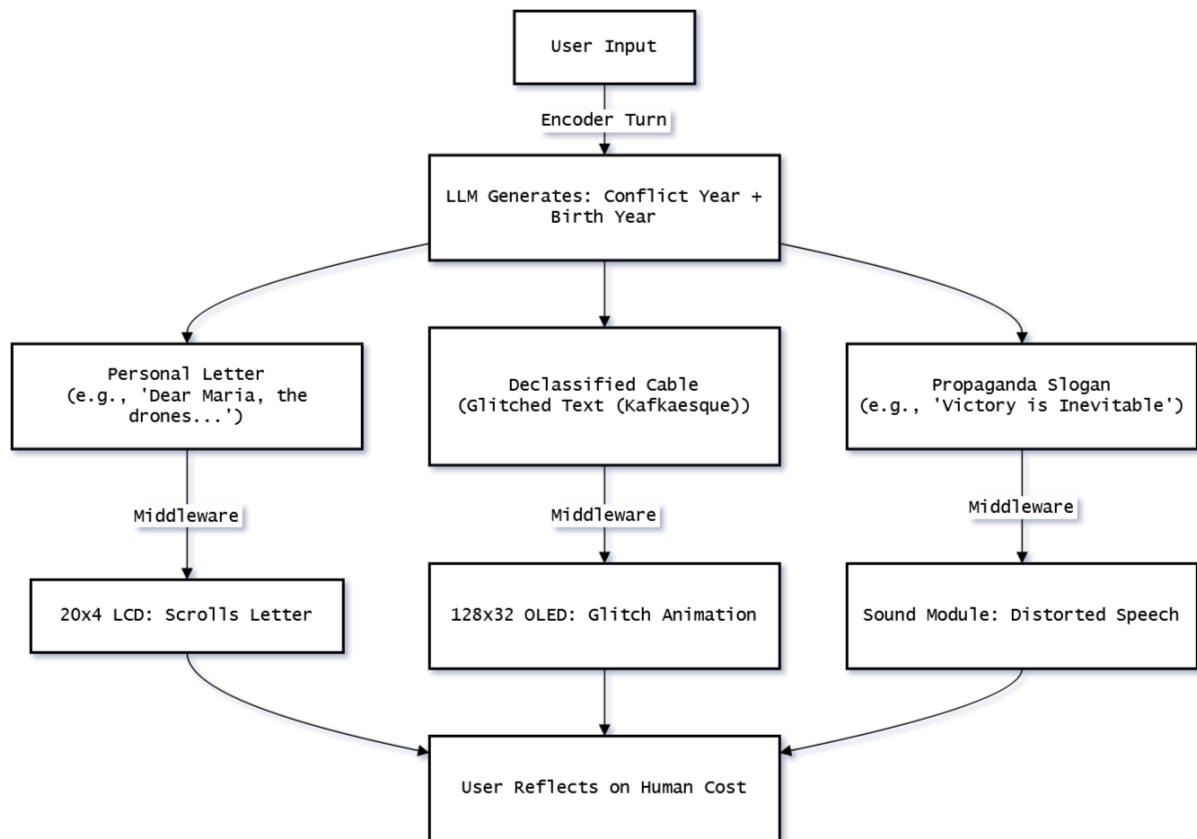


Figure 7 Narrative Fragmentation Logic (Designed by the author, 2025)

6.3 Role of User Choice

In this installation, the role of user choice is integral to shaping the experience. Users are not passive recipients of the narrative; rather, they actively engage with it, making choices that influence the content they encounter. The installation's interface is designed in such a way that users can select specific themes or layers of information, guiding them through the narrative in a way that feels personal and interactive.

For instance, a user might choose a conflict zone, such as a region involved in recent military conflict, and then decide whether to explore the historical facts surrounding that area or venture into a speculative scenario about what the future might hold. Each choice leads to different pathways, with distinct themes, tones, and content, reinforcing the sense of agency and control over the narrative. These choices are not merely about content but also about tone. Selecting a theme such as surveillance, for example, might prompt AI-generated content that highlights the invasion of privacy and the pervasive reach of state control in times of conflict. In contrast,

focusing on the human side of the narrative might reveal personal stories of displacement, loss, and survival, creating an emotional counterpoint to the otherwise detached, data-heavy sections.

This emphasis on choice allows users to navigate the installation on their terms, exploring the complex realities of war from angles that interest or resonate with them most. At the same time, it reinforces the thematic core of the installation—the idea that war, much like the narrative itself, is not a singular, easily understood event but a collection of stories, choices, and consequences, each shaped by the individual.

6.4 Immersive Design

The immersive design of the installation is crucial in shaping the user experience, creating an environment that is both physically and emotionally engaging. Through a combination of lighting, sound, and visual aesthetics, the installation evokes the feeling of being in a space where every element—every flicker of light, every sound, and every visual cue—contributes to the narrative's atmosphere.

Lighting is one of the primary tools used to convey the oppressive nature of the installation. The space is deliberately dimly lit, with strategically placed LED panels serving as focal points. These lights simulate environments that feel oppressive, constrained, and unstable. A central light source flickers intermittently, representing the unreliable and fragile nature of life in conflict zones. This flickering light evokes the sense of a shelter, perhaps under attack or on the brink of collapse, where survival is uncertain. The dynamic nature of the lighting, which changes in response to user actions, further enhances the immersive experience. A sudden blackout, or a shift to a red-alert lighting state, simulates the uncertainty and terror of a world in crisis.

Sound plays an equally significant role in the immersive atmosphere. The soundscapes evolve with user interaction, subtly shifting from ambient noises that create a sense of foreboding to more specific sound cues that correspond with the user's actions. At times, haunting, distant

noises fill the room—ambient sounds of a world at war, such as the rhythmic march of soldiers, static interference from intercepted broadcasts, or the rumbling of distant explosions. These sounds heighten the sense of unease, as users are reminded of the pervasive presence of conflict. At other moments, the soundscape becomes more intimate: whispered voices, the faint hum of electronic signals, or the clattering of machinery. These shifts in sound draw the user deeper into the experience, inviting them to reflect on their own relationship with the content they are engaging with.

The use of **visual aesthetics** is minimalist yet powerful. Inspired by the industrial aesthetics of works such as *Papers, Please* and the abstract visual design of Ryoji Ikeda, the installation features stark, monochrome graphics that emphasize surveillance and control. Blinking indicators, digital displays, and simple, utilitarian visuals reinforce the themes of a world under constant observation. This industrial design is not just a stylistic choice; it serves to communicate the dehumanizing aspects of war and conflict, where individuals are reduced to mere data points in larger systems of control. The visual simplicity allows users to focus on the core themes, without distraction, while the raw, gritty design enhances the sense of alienation and oppression.

6.5 Impact and Empathy

The installation aims to strike a delicate balance between emotional detachment and profound empathy. Through its fragmented narrative structure, it first encourages users to engage with the data in an intellectual and analytical manner, before gradually drawing them into a more personal connection with the human side of conflict. This journey from detachment to empathy is central to the installation's goal of fostering deeper understanding and reflection on the human cost of war.

Disassociation is the first emotional phase that users encounter. The fragmented nature of the content, alongside the abstract visuals and data-heavy environment, creates an initial sense of distance from the subject matter. The use of factual data—such as casualty numbers, geopolitical shifts, and military strategies—encourages a detached, almost clinical approach to understanding the complexities of conflict. By presenting this data through visual

representations such as graphs and maps, users are given an analytical lens through which to view the larger scope of war. For example, casualty figures might be shown in stark, impersonal charts, offering an overview of loss without delving into the emotional toll. This approach allows users to digest the information without being overwhelmed by the rawness of human suffering, providing a mental space for reflection before emotional engagement.

However, as users progress deeper into the installation, the atmosphere begins to shift. **Empathy** emerges as the narrative turns towards more personal stories. This transition occurs as users encounter AI-generated personal narratives, letters, and intercepted communications that reflect the lives of individuals affected by war. These narratives are intentionally designed to be emotionally resonant, drawing users back into a more human experience of conflict. For example, a letter from a soldier to their family, describing their experiences on the front lines, might create a moment of profound emotional connection. The shift from data-driven analysis to human experience deepens the impact of the installation, as users are forced to confront the personal stories behind the statistics. The use of ambient sound—like the whispers of loved ones or the distant rumble of explosions—enhances this shift, enveloping users in a soundscape that mirrors the human toll of conflict.

The interplay between detachment and empathy encourages users to reflect on their own emotional responses. The installation's design encourages critical thought, yet it also opens the door for a more personal, emotional understanding of the consequences of war. As users piece together the fragmented narrative, they are invited to confront the reality that, despite the often impersonal nature of global conflicts, war affects real people—individuals with families, hopes, and dreams. This emotional progression is designed to leave a lasting impact, prompting users to reconsider their perception of global conflicts and the human beings caught within them.

The installation also creates a sense of personal responsibility, as users are given agency in navigating the narrative. Through their choices, they directly influence how they experience the war and its consequences. This empowers users, giving them a sense of participation in the unfolding story while also reinforcing the complexity of global conflicts. By engaging with

these issues on a personal level, users are invited to confront the larger question of how they, as individuals, relate to and understand the consequences of war in the world around them.

Furthermore, the installation's structure encourages users to reflect on their own place within a global narrative. Data comparisons—such as the number of casualties since the user's year of birth—force users to situate themselves within the context of global conflict, highlighting the ways in which war continues to shape and define the world around them. These comparisons are subtle yet impactful, prompting introspection on the user's own experiences, milestones, and how they align with the broader sweep of history. In this way, the installation does not just engage users intellectually but invites them to place themselves within the global narrative of war, reinforcing the interconnectivity of human lives across time and space.

6.6 Conclusion

The narrative and atmosphere of this installation are carefully designed to encourage both intellectual engagement and emotional reflection. By employing fragmented storytelling techniques, users are able to piece together the disordered and multifaceted nature of war, mirroring the chaos and complexity of real-world conflicts. The installation uses AI-generated content, historical context, and speculative scenarios to create a rich, immersive experience that evolves based on user choices, reinforcing the active role of the user in shaping their experience.

The immersive design—through its use of lighting, sound, and minimalist aesthetics—enhances this engagement, evoking a sense of urgency, unease, and disconnection, while gradually drawing users into a more personal connection with the human side of conflict. Through this progression from detachment to empathy, the installation aims to foster a deeper understanding of the human cost of war and its global implications.

Ultimately, the installation is not just a space for passive observation but an interactive environment where users are encouraged to reflect on their own relationship with global conflicts. It asks them to question their own emotional responses, confront the realities of war, and consider their place within the broader human experience. By embedding the user within

a fragmented yet immersive narrative, the installation seeks to leave a lasting impression, prompting critical thought, emotional engagement, and, ultimately, a greater awareness of the complexities of war and its enduring impact on the human condition.

7. Evaluation and Reflection

I designed this installation as a conceptual exploration of interactive media for political education on war, surveillance, and propaganda. This project remains an idea and a set of design principles—I have not realized it physically nor tested it with any users. In this chapter, I reflect on my design process, evaluate my decisions, and outline the lessons learned during development.

7.1 Assessing the Design's Conceptual Effectiveness

I envisioned the installation to engage the user by provoking both thought and emotion. I combined 64x32 LED panels that display fragmented data in rapid sequences. I integrated tactile elements such as rotary encoders, large mechanical buttons, and pressure-sensitive panels to force a deliberate physical interaction. For example, when a button is pressed, the console triggers the display of casualty statistics alongside AI-generated personal narrative fragments. I designed these interactions to shift abruptly from cold, numerical data to vivid, speculative testimonies—an effort to mirror the dehumanizing effects of war and bureaucratic control.

In my self-evaluation, I scrutinized whether these design choices could evoke discomfort and critical reflection. I compared my approach to inspirations like *Papers, Please* and Beckett's surreal narratives. I believe that the contrast between impersonal data and emotionally charged narratives helps bridge the gap between abstract numbers and human experience. Although I have not observed external reactions, my critical review of each design element assures me that every component contributes to a cohesive, impactful narrative.

7.2 Challenges and Lessons in the Design Process

Creating a design that is both conceptually rich and technically cohesive posed several challenges. I initially overloaded the interface with multiple layers of dynamic content, which soon proved too distracting. I revised the design by stripping away extraneous elements and focusing on essential interactions: a press of a button, a shift in display, and a brief narrative pause. This simplification allowed me to preserve the emotional core without overwhelming the viewer.

Technically, I integrated ESP32 microcontrollers with Python middleware to control the LED panels and sensors. I planned for a dynamic narrative generated in real-time by a local language model. However, I encountered limitations due to hardware constraints. To overcome these issues, I opted for pre-rendered text sequences that trigger in response to input. Although this approach sacrifices some real-time adaptability, it ensures smooth operation—a compromise I accepted after thorough testing of the individual components.

Balancing thematic depth with a clear, accessible design also challenged me. I grappled with conveying the complexity of war and surveillance without resorting to dense exposition. Instead, I divided the experience into moments of stark numerical displays and sudden narrative insights, a structure inspired by the tension found in Kafka's work. This deliberate pacing, interspersed with moments of silence, aims to prompt the user to pause and reflect—a strategy I believe effectively embodies the intended dehumanization and bureaucratic absurdity.

7.3 Insights on Emotional Impact and Narrative Structure

I crafted the installation to generate emotional dissonance. The physical design—a steel-framed console paired with a harsh glow from LED panels—creates a jarring, almost oppressive atmosphere. I intentionally used low-frequency sound pulses to accentuate this mood. When the display abruptly shifts from a string of numbers to a personal narrative, the resulting contrast disrupts the viewer's expectations and forces a moment of introspection.

I structured the narrative to oscillate between impersonal data and intimate, speculative accounts. This deliberate juxtaposition aims to expose the dehumanizing nature of modern conflicts. In my reflective process, I observed that such rapid transitions can instill a sense of urgency and unease. I programmed brief pauses after each narrative fragment, drawing on theories of attention and pacing, to allow the viewer—or in my case, myself—to absorb the message. Although I have not tested this with an external audience, my internal reviews suggest that this method effectively challenges the viewer to confront the realities of war and systemic control.

7.4 Future Directions and Improvements

I see the current design as a foundation for further development. In future iterations, I plan to explore networked interactions where multiple consoles could operate in tandem, each representing a different perspective—be it that of a soldier, a civilian, or an official. This

expansion would allow for a richer, more complex narrative, reinforcing how information can be manipulated based on one's position within a conflict.

I also aim to integrate biometric sensors that respond to physical cues like heart rate. By adjusting narrative pacing and content based on real-time physiological data, I could create a more personalized and emotionally resonant experience. Additionally, I intend to upgrade the AI component to replace pre-rendered sequences with more fluid, unpredictable generative text. This shift would enhance the realism of the interaction, though it would require overcoming significant computational challenges.

Materially, I consider exploring different tactile interfaces. While the current design relies on mechanical buttons and rotary encoders, I may experiment with analog dials or even a touch-sensitive glass panel that simulates the cold, unyielding feel of bureaucratic control. I believe these refinements would further anchor the installation's themes in tangible, memorable experiences.

In summary, my design reflects a personal and critical inquiry into how interactive media can transform abstract political themes into a palpable, experiential narrative. Although the installation exists only as a design concept, my rigorous reflection on each element reaffirms the potential of interactive systems to challenge and engage. I look forward to exploring these ideas further in future projects, where I may have the opportunity to test and iterate on this framework in a real-world setting.

8: Conclusion

8.1 Final Reflections on the Project

In this project, the interactive installation combines essential themes of war, surveillance, and propaganda, using media and technology as an artistic means of social critique. The purpose of the installation was to engage the viewer, not simply with information, but with a sensory, emotional experience that forces them to reflect on the hidden power structures and complexities of global conflicts. Through its abstraction and dynamic interactions, it seeks to break the traditional ways of consuming knowledge, offering a more personal experience than conventional media.

The process of creating this work revealed how vital it is to balance technology and accessibility. Despite the technical limitations, the installation succeeds in challenging passive engagement. It encourages active participation and critical thought, fostering an emotional connection that traditional forms of information dissemination often lack. It pushes the audience to think, not just about the facts, but about their emotional response to those facts, something deeply embedded in the goals of interactive media as an educational tool. The interplay of abstraction with interactive experiences brings a new level of understanding, one that resonates more deeply than mere knowledge alone.

8.2 Limitations and Open Questions

Despite its successes, the installation faces some unresolved challenges. Computational constraints limit its ability to create the true unpredictability found in human behavior, making the narrative still feel somewhat static despite its generative nature. Additionally, the installation struggles with fully realizing the immersive potential of real-time complexity, something that would further enhance its emotional and intellectual impact.

Ethical concerns also emerge from the use of surveillance-like techniques within the work. The very tools that critique modern surveillance systems are inherently tied to the privacy and autonomy of the users interacting with them. While the project aims to expose the mechanisms of control, it inadvertently engages in some of the same practices it critiques, making the

question of ethical design particularly relevant. Accessibility is another concern—how to ensure the work remains accessible to audiences unfamiliar with the technicalities of digital art or abstract storytelling. These challenges are key to consider in future iterations.

8.3 Future Research and Application

This installation opens up important avenues for future exploration in both interactive media and socio-political critique. Its potential lies in refining the emotional engagement and narrative adaptability, moving beyond the current limitations of its generative technology. The dynamic nature of the installation offers opportunities for deeper, more personalized interactions, enhancing the immersive experience. Future work could explore more complex narratives that adapt in real-time to the user's actions, providing a more tailored experience that feels increasingly reflective of human unpredictability.

Moreover, the installation could benefit from expanding its educational potential, particularly within the realms of digital activism and critical media. There is a growing need for interactive experiences that tackle political issues with a combination of emotional and intellectual depth. By continuing to develop participatory elements—such as allowing users to contribute content or interact with the narrative in more profound ways—future versions of this installation could push the boundaries of how political narratives are communicated. The integration of more adaptive storytelling techniques would allow for greater user engagement, while still ensuring that the work remains accessible and thought-provoking.

The ethical questions raised in this project regarding the use of surveillance-like techniques, like the human detecting radar sensor or the ultrasonic distance meter, also suggest a broader discussion for future research. In a world increasingly shaped by surveillance and data manipulation, the challenge of critiquing such systems while avoiding complicity is essential. Ethical design in interactive art will become even more crucial as these installations grow in influence, particularly as they engage sensitive issues like privacy, power, and control.

Ultimately, this installation serves as a prototype for more expansive work in the intersection of technology, art, and political discourse. It not only seeks to engage its audience intellectually but also aims to evoke empathy and personal reflection on global issues. The hope is that this

project will inspire other creators to explore the potential of interactive media as a tool for social change, helping people engage more meaningfully with political and historical narratives. As the project evolves, it holds the potential to become a more powerful catalyst for critical discourse and activism.

This work is a step toward integrating art, technology, and political education in a way that encourages deeper reflection and meaningful engagement. It stands as an invitation for future creators to explore how interactive media can shape awareness, empathy, and, ultimately, activism.

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GPT-4o was used to assist in drafting early versions of this dissertation, with all content subsequently revised and verified by the author.

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Author's Statement:

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